Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 144 (2014) 66 – 78

Procedia
Social and Behavioral Sciences

5th Asia Euro Conference 2014

A spatiotemporal study of outbound traveling market in Taiwan

Yin-Hao Kuo[a,b,*], Chia-Jui Tsai[b], Yi-Chun Hsu[b], Chun-Wei Wu[b]

[a]*National Taiwan University of Science and Technology, Taipei, Taiwan*
[b]*Taipei Chengshih University of Science and Technology , Taipei, Taiwan*

Abstract

Based on the official data offered by Tourism Bureau, M.O.T.C., Republic of China, monthly visitors with different genders and ages destined to 12 main outbound countries, including Japan, Hong Kong, Macau, Mainland China, Korea, U.S.A, Singapore, Thailand, Philippines, Indonesia, Malaysia, and Vietnam as well, from 2003 to 2012 have been collected and analysed to demonstrate and explore the static and dynamic patterns behind these historical records.Statistical procedures including correlation analysis, K-Means clustering, MANOVA analysis, and multidimensional scaling, or MDS for short, were respectively adopted to discover the correlative relation among each different spatiotemporal market, classify and cluster each outbound market into a suitable cluster based on their similarity, testify the hypotheses of heterogeneous cluster centers, and down-level the spatial complexity from high-dimension to 2-dimension in order to better interpret the patterns revealed behind the original space.

Peer-review under responsibility of the Scientific Committee of 5AEC2014.
Keywords: Tourism demand; Outbound traveling market; Clustering; MDS

1. Introduction

As being a demanding-driven and service-oriented industry that had been experienced rapid growth and innovation during decades, tourism constantly plays a key role in the economy growth through employment, foreign exchange earnings, investment, and regional development. Thus, from the economics' viewpoint, tourism industry contributes a certain percentage of nation's GDP overall no matter in a directly or indirectly way (Chu, 2008).

* Corresponding author. Tel.: +88-622-896-8492; fax: +88-622-896-8496.
E-mail address: yhkuo@tpcu.edu.tw

Peer-review under responsibility of the Scientific Committee of 5AEC2014.
doi:10.1016/j.sbspro.2014.07.275

Due to the perishable nature of the tourism industry, the need to carry accurate forecasts has become more and more crucial (Chandra & Meneze, 2001; Law, 2000; Law & Au, 1999). Meanwhile, no matter in which country or market, since tourism demand is the essential foundation on which all tourism-related business decisions conclusively rest (Song & Witt, 2006), the forecasting of tourism demand always keep on attracting lots of attentions and interests during last few decades among researchers, practitioners, and policy makers. Just possessed under the command of science and art, the forecasting of tourism demand can be modeled in various ways. They include exponential smoothing (Cho, 2003), ARIMA (Cho, 2003; Chu, 1998; Goh & Law, 2002; Lim & McAlee, 2002), vector autoregressive (Song & Witt, 2006; Wong, Song, & Chon, 2006), neural network (Chen & Wang, 2007; Cho, 2003; Law, 2000; Law & Au, 1999), fuzzy time series (Wang, 2004; Wang & Hsu, 2008), grey model (Hsu & Wen, 1998; Wang, 2004), adaptive network-based fuzzy inference system (Chen, Ying, & Pan, 2010), econometric (Hiemstra & Wong, 2002; Smeral, Witt, & Witt, 1992; Song & Wit, 2000; Witt & Martin, 1987), regression-base model (Chan, 1993; Crouch, Schultz & Valerio, 1992; Kulendran & Witt, 2001), and genetic algorithm (Chen & Wang, 2007; Hernandez-Lopez & Caceres-Hernandez, 2007; Hernandez-Lopez, 2004; Hurley, Moutinho & Witt, 1998).

Most of interests mentioned above, when evaluating and testing the data from markets selected, focused on models' building and aimed to demonstrate the capability or potential of these methods chosen. The purpose of modeling was expected to outperform, or not worse than at least, some well-accepted modeling competitors. In contrast with much attention for prediction modeling in the field of tourism demand, studies which spatial and temporal patterns were simultaneously discussed seem to attract even less attention among researchers during the last decade. In this paper, a spatiotemporal exploration of outbound traveling market in Taiwan is conducted.

The monthly data from year 2003 to 2012 are from the Tourism Bureau of Republic of China (Taiwan), and the number of outbound visitors for different genders and ages traveling in the top 12 outbound destinations, including Hong Kong, Japan, Mainland China, Macao, USA, Korea, Thailand, Vietnam, Indonesia, Singapore, Malaysia, and Philippines, is collected and analyzed in this study.

The purpose of this article, unlike models construction which often discussed in the tourism demand field, is to explore, compare, cluster, and scale among the 12 top outbound destination markets not only in a spatial but a temporal viewpoint with respective to different genders and ages. The rest of this paper is organized as follows: section 2 presenting review of the relevant literature and listing the descriptive statistics of collected data, section 3 outlining the methodology of the whole analysis process and section 4 describing the empirical finding, while discussing and conclusions are drawn at Section 5.

2. Literature Review

According to the investigation of The World Tourism Organization (UNWTO) published in 2013, in year of 2012, the number of international tourist arrivals (ITA) first exceeded 1 billion in history to 1.035 billion, and the international tourism receipts (ITR) grew by 4% in real terms in 2012, hitting a new record of US$ 1,075 billion worldwide. The raise of ITR was mirrored by the growth in ITA, which also lifted 4%, and supported the significant correlation between these two key indicators usually observed in evaluating the international tourism trend. Unsurprisingly, Asia and the Pacific recorded the fastest growth worldwide in UNWTO regions, with a 7% increase in international arrivals. Africa observed an increase of 6%, reaching 50 million for the first time ever. The Americas also experienced sustained growth with 5% more arrivals. Europe, which accounts for over half the world's total, recorded a 3% increase, or 18 million more arrivals. On the contrary, the Middle East (-5%) has not yet succeeded in returning to growth. The corresponding statistics and market share collected from UNWTO and International Monetary Fund (IMF) is shown in figue.1 and table 1.

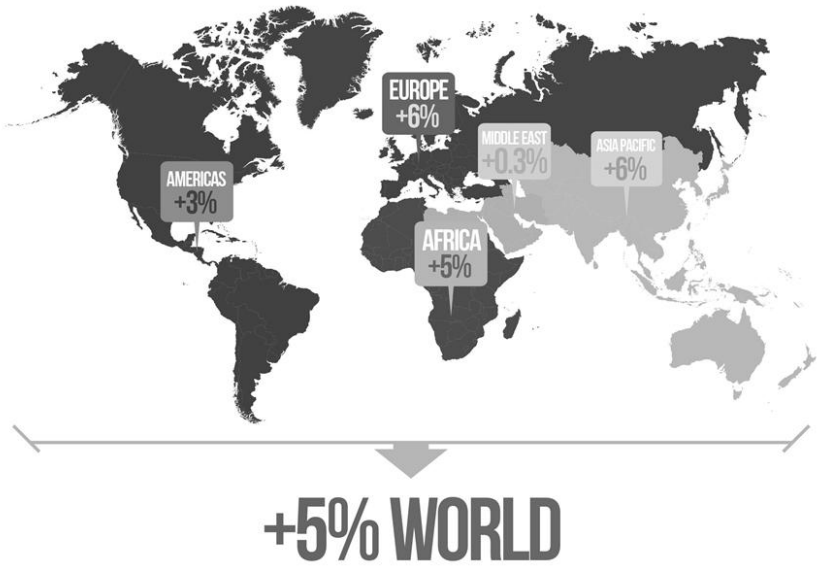

Fig. 1. ITA worldwide 2013 (compared to the same period in 2012) (Source: UNWTO)

Table.1. International Tourist Arrivals

Region	International Tourist Arrivals (Million)							Market share(%)	Change (%)	Average annual Growth(%) 05-12
	1990	1995	2000	2005	2010	2011	2012	2012	2012/2011	
World	**436.0**	**529.0**	**677.0**	**807.0**	**949.0**	**995.0**	**1,035.0**	**100.0**	**4.0**	**3.6**
By IMF's Classification										
Adavanced economies	297.0	336.0	420.0	459.0	506.0	530.0	551.0	53.2	3.8	2.6
Emergine economies	139.0	193.0	256.0	348.0	443.0	465.0	484.0	46.8	4.3	4.8
By UNWTO regions										
Europe	**262.7**	**305.9**	**388.0**	**448.9**	**485.5**	**516.4**	**534.2**	**51.6**	**3.4**	**2.5**
Northern Europe	29.8	37.7	46.4	60.4	62.8	64.0	64.9	6.3	**1.4**	1.0
Western Europe	108.6	112.2	139.7	141.7	154.3	161.5	166.6	16.1	3.2	2.3
Center/Eastern Europe	33.9	58.1	69.3	90.4	95.0	103.9	111.6	10.8	7.4	3.1
Southern/Mediter Europe	90.3	98.0	132.6	156.4	173.5	187.0	191.1	18.5	2.2	2.9
- of which EU-27	231.3	267.7	326.8	356.1	371.0	390.9	400.2	38.7	2.4	1.7
Asia and the Pacific	**55.8**	**82.0**	**110.1**	**153.6**	**205.1**	**218.2**	**233.6**	**22.6**	**7.0**	**6.2**
North-East Asia	26.4	41.3	58.3	85.9	111.5	115.8	122.8	11.9	6.0	5.2
South-East Asia	21.2	28.4	36.1	48.5	70.0	77.3	84.6	8.2	9.4	8.3
Oceania	5.2	8.1	9.6	11.0	11.6	11.7	12.1	1.2	4.1	1.4
South Asia	3.1	4.2	6.1	8.1	12.0	13.5	14.1	1.4	4.4	8.2
Americas	**92.8**	**109.0**	**128.2**	**133.3**	**150.4**	**156.0**	**163.1**	**15.8**	**4.6**	**2.9**
North America	71.7	80.7	91.5	89.9	99.3	102.1	106.7	10.3	4.5	2.5
Caribbean	11.4	14.0	17.1	18.8	19.5	20.1	20.9	2.0	3.8	1.5
Central America	1.9	2.6	4.3	6.3	7.9	8.3	8.9	0.9	7.5	5.0
South America	7.7	11.7	15.3	18.3	23.6	25.5	26.7	2.6	4.8	5.5
Africa	**14.8**	**18.8**	**26.2**	**34.8**	**49.9**	**49.4**	**52.4**	**5.1**	**5.9**	**6.0**
North Africa	8.4	7.3	10.2	13.9	18.8	17.1	18.5	1.8	8.7	4.2
Sub-Saharan Africa	6.4	11.5	16.0	20.9	31.1	32.4	33.8	3.3	4.4	7.1
Middle Ease	**9.6**	**13.7**	**24.1**	**36.3**	**58.2**	**54.9**	**52.0**	**5.0**	**-5.4**	**5.2**

Since 1948, the developing of tourism industry in Taiwan has been segmented into 4 periods according to Tourism Bureau of Taiwan: initial, leading-in, growing and mature period, it can be separately described as follows (http//admin.taiwan.net.tw).

(1) Initial period （1948-1959）

Caused by retreating from Mainland in the civil war and migrating to Taiwan lately at the end 1940, the Taiwan government carried a strictly security protection in maintaining the stability of politics, economics, and society. Particularly owing to the constitutional-level ban, regarded as Temporary Provisions Effective During the Period of National Mobilization for Suppression of the Communist Rebellion, was implemented 1948, the protectionism lastingly impacted not only in politics and military affairs, but in tourism as well. Since 1948, issued through grants, loans, technological cooperation and selling or giving American agricultural products under Public Law 480, Taiwan got help from US. And tourism was one of the benefitted industries among all technical supporting plans.

(2) Leading-in period （1960-1978）

In company with awareness of leisure getting more and more important to public, the government untied restrained ban gradually. The openings in this stage included the traveling agency can be applied and run by the local people, the tourism developing committee was founded, the encouraged-investment of international tourism hotels was legislated, the national parks, national scenic areas, and forest parks were consecutively established.

(3) Growing period （1979～1996）

Taiwan revoked the ban of prohibiting citizen abroad traveling for sightseeing reason in 1979. Accompanying with significant economic growth, Taiwan experienced sustained growth in outbound visitors since then. Followed by political unban allowing citizens to visit their relatives in Mainland China under humanism thinking, the growth was prompted even higher than before. The awareness of appropriate leisure needed for humanity was getting rigid gradually.

(4) Mature period （1997-）

On account of appropriate leisure was popularly expected, Taiwan started leading-in a two-day weekend since 1998 partially, and done fulfilling in 2001 successfully. Since then, the developing of tourism industry kept on prospering due to pursuing the balance of working and leisure among people in Taiwan.

3. Data and research methodology

3.1. Data

As one of the key choice in enjoying a vacation and geographically positioned in the hinge of East Asia, outbound travelling in Taiwan always attracted people when programing and determining their vacations. According to the data systematically collected by authorities, except for USA, there are 11 Asian destinations, including Japan, Hong Kong, Macau, Mainland China, Korea, Singapore, Thailand, Philippines, Indonesia, Malaysia and Vietnam, preferred by Taiwan visitors among the top 12 outbound destinations in the past decade. Since the ban of forbidding Taiwanese going to China in sightseeing purpose was removed in July 2008, the visitors travelling to Mainland dramatically increased form 168,427 in 2008 to 3,139,055 in 2012, or equivalently, grew 18.64 times within 5 years.

Monthly tourist arrivals records to dozen-top outbound destinations from 2003 to 2012 were collected from official data bank in Taiwan. In spite of total tourist arrivals, different genders and age-stratums with their sharing weights calculated from the total arrivals in each market, were also collected and analyzed in this study to explore the spatiotemporal changings and trends. The tourists of seven age stratums, including 12 and below, 13 to 19, 20 to 29, 30 to 39, 40 to 49, 50 to 59, and 60 and above as well, were counted from the original categorization. Table 2 concludes the outbound tourists and index of the top 12 destinations from 2003 to 2012. The visitors in 2011 were set to be base lines in each destination with indexed 100 to reflect the correlative changing trends. The index of visiting destination of Taiwan 2003 to 2012 is offered in Fig. 2.

Table.2. An overview of Taiwanese tourists to 12-top outbound destinations

Year	Hong Kong	Japan	China	Macao	U.S.A.	Korea	Thailand	Vietnam	Indonesia	Singapore	Malaysia	Philippines
2003	1,869,069	731,330		837,936	479,264	179,893	392,414	222,487	251,284	125,491	121,267	91,418
2004	2,559,705	1,051,954		1,038,006	536,217	298,325	422,189	266,115	283,757	160,088	180,883	112,552
2005	2,807,027	1,180,406		1,163,822	578,998	368,206	268,231	234,009	185,348	184,926	161,296	119,125
2006	2,993,317	1,214,058		1,232,232	593,794	396,705	379,275	242,852	186,165	204,834	181,911	110,041
2007	3,030,971	1,280,853		1,196,110	587,872	457,095	353,439	272,020	201,358	189,835	187,788	107,824
2008	2,851,170	1,309,847	168,427	926,593	515,590	363,122	332,997	285,263	186,117	167,479	157,650	114,155
2009	2,261,001	1,113,857	1,516,087	739,263	415,465	388,806	258,449	264,819	173,429	137,348	153,695	97,372
2010	2,308,633	1,377,957	2,424,242	667,910	436,233	406,290	350,074	313,987	179,845	166,126	212,509	139,762
2011	2,156,760	1,136,394	2,846,572	587,633	404,848	423,266	382,635	318,587	212,826	207,808	209,164	178,876
2012	2,021,212	1,560,300	3,139,055	527,050	469,568	532,729	306,746	341,511	198,893	241,893	193,170	211,385

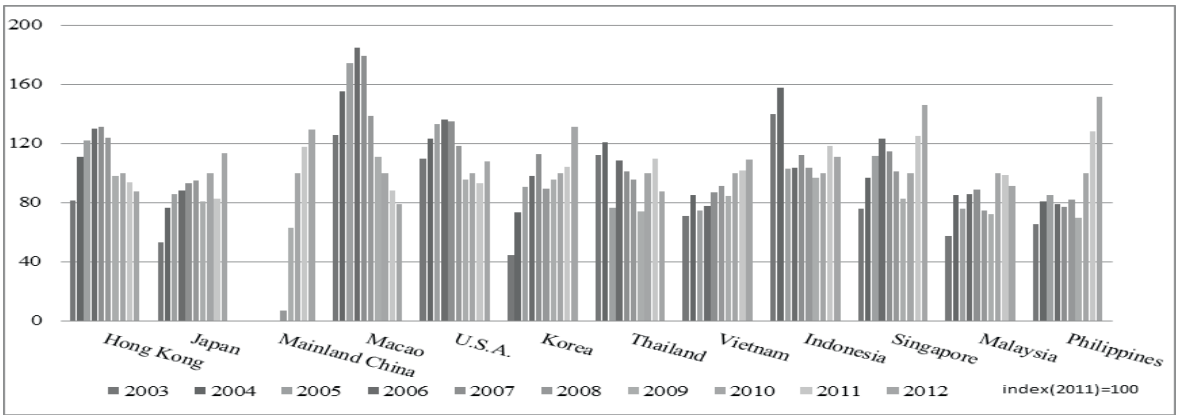

Fig.2. Indexes of Taiwanese tourists to 12-top outbound destinations 2003 to 2012

3.2. Research methodology

Through a series of statistical procedures, including descriptive statistics, correlation analysis, K-means clustering, 1-way MANOVA, and MDS (multidimensional scaling), this study explores the central and dispersion tendency of analysed data, calculates correlation coefficients between variables, assigns each record into proper cluster by calculating the distances to every clusters, testifies the heterogeneous means exists for different clusters, and reduces dimension from high to 2 for better observation and interpretation, respectively.

Since monthly tourist arrivals to dozen-top outbound destinations with respected to different genders and age stratums are collected for this study, it makes us capable to conduct lots of descriptive statistics under any cross tabulations. Three cross tabulations, therefore, are offered below to preview the scaling and percentage of different viewpoints. Table 3 to 5 respectively describe the monthly tourist means, quarterly percentages for genders, and overall percentage for 7 age stratums to each destination from 2003 to 2012.

Table.3. Monthly tourist means to outbound destinations 2003 to 2012.

Market \ Month	1	2	3	4	5	6	7	8	9	10	11	12	Mean
Hong Kong	172,687	162,344	140,015	165,907	162,217	182,643	199,490	185,595	157,013	181,475	149,827	161,999	168,434
Indonesia	20,955	15,326	14,929	16,200	16,795	19,619	21,085	16,802	16,232	18,961	11,537	10,452	16,574
Japan	133,945	90,318	94,258	143,550	132,010	137,292	166,674	141,957	124,637	142,486	132,920	120,253	130,025
Korea	43,511	42,984	34,886	42,203	40,460	48,558	56,027	54,680	43,997	47,497	38,561	39,365	44,394
Macao	39,986	40,875	38,428	41,305	39,191	43,831	54,450	52,239	47,937	45,955	39,890	42,963	43,921
Mainland China	258,728	248,837	236,894	266,709	272,775	268,283	296,306	271,159	247,490	292,306	250,231	229,337	261,588
Malaysia	21,111	15,799	12,641	12,576	14,543	16,458	24,899	19,567	16,325	14,769	11,865	12,617	16,098
Philippines	21,298	17,322	16,900	16,967	18,407	19,762	22,693	18,904	15,469	17,187	14,086	12,390	17,615
Singapore	26,579	22,601	16,546	18,758	16,446	18,825	28,561	22,439	17,159	17,959	17,478	18,542	20,158
Thailand	19,794	18,283	20,340	20,932	25,542	28,293	28,570	26,259	28,242	28,707	31,289	30,495	25,562
U.S.A.	58,137	31,839	32,463	36,456	39,012	47,638	53,530	49,592	36,420	35,328	25,066	24,087	39,131
Vietnam	37,478	27,787	26,232	30,294	30,057	27,243	36,362	26,120	23,935	27,979	23,697	24,327	28,459

Table.4. Quarterly percentages for genders to outbound destinations 2003 to 2012.

Market	Q1		Q2		Q3		Q4		All Quarters	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Hong Kong	62.96%	37.04%	63.93%	36.07%	60.00%	40.00%	63.62%	36.38%	62.63%	37.37%
Indonesia	49.86%	50.14%	49.32%	50.68%	48.85%	51.15%	51.57%	48.43%	49.90%	50.10%
Japan	43.81%	56.19%	42.21%	57.79%	42.89%	57.11%	43.81%	56.19%	43.18%	56.82%
Korea	42.48%	57.52%	42.59%	57.41%	41.22%	58.78%	40.81%	59.19%	41.78%	58.22%
Macao	68.62%	31.38%	70.24%	29.77%	66.35%	33.65%	69.38%	30.62%	68.65%	31.35%
China	65.05%	34.96%	65.46%	34.55%	62.56%	37.44%	65.23%	34.77%	64.50%	35.50%
Malaysia	49.09%	50.92%	49.37%	50.63%	47.53%	52.48%	49.89%	50.11%	48.97%	51.03%
Philippines	56.56%	43.44%	57.13%	42.87%	54.15%	45.85%	56.96%	43.04%	56.20%	43.80%
Singapore	49.01%	50.99%	49.57%	50.43%	48.07%	51.93%	50.05%	49.95%	49.18%	50.82%
Thailand	50.61%	49.39%	51.01%	48.99%	48.26%	51.74%	52.60%	47.40%	50.62%	49.38%
U.S.A.	48.01%	51.99%	47.26%	52.74%	46.51%	53.49%	48.67%	51.33%	47.61%	52.39%
Vietnam	65.14%	34.86%	67.65%	32.35%	64.85%	35.15%	66.92%	33.08%	66.14%	33.86%
Mean	53.70%	46.30%	54.07%	45.93%	52.17%	47.83%	54.51%	45.49%	53.61%	46.39%

Table.5. Percentages of 7 age stratums to outbound destinations 2003 to 2012.

Market \ Age str.	12 & below	13 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 & above
Hong Kong	4.16%	1.98%	12.51%	26.90%	26.57%	18.56%	9.33%
Indonesia	6.38%	2.58%	23.12%	29.30%	18.71%	13.07%	6.83%
Japan	6.26%	3.62%	18.05%	24.93%	18.85%	15.71%	12.57%
Korea	5.64%	3.89%	20.30%	26.77%	19.93%	13.94%	9.52%
Macao	3.51%	1.71%	9.92%	24.20%	27.84%	21.35%	11.47%
China	4.41%	1.93%	6.89%	20.14%	26.59%	24.85%	15.19%
Malaysia	6.59%	3.35%	17.31%	25.52%	21.23%	16.16%	9.83%
Philippines	5.77%	2.84%	18.01%	26.30%	22.00%	16.51%	8.58%
Singapore	7.12%	4.50%	16.15%	27.15%	22.01%	14.53%	8.54%
Thailand	5.16%	2.97%	20.29%	25.86%	20.53%	15.80%	9.37%
U.S.A.	4.44%	3.82%	16.12%	22.04%	18.43%	19.16%	15.99%
Vietnam	9.75%	0.90%	8.94%	21.78%	24.85%	21.92%	11.87%
Mean	5.83%	2.89%	16.05%	25.31%	22.09%	17.28%	10.55%

4. Empirical finding

4.1. Correlation analysis

Correlation analysis examines the strength of association between two variables by calculating their correlation coefficient. The Pearson correlation is the most commonly used parametric method among all variations for this analysis (Larry et al., 2012). Limited by words and spacial restriction, only few correlation tables are illustrated here. Table 6 describes the correlation between countries calculated by yearly visitors from 2003 to 2012, and table 7 offers the correlation between different age stratums calculated by monthly weights from 2003 to 2012.

Table.6. Correlation coefficients between countries on yearly visitors 2003 to 2012.

Corr. Coef..	China	Japan	Indonesia	USA	H.K.	Thailand	Malaysia	Philippi.	Vietnam	Singapore	Macao	Korea
China	1											
Japan	.297	1										
Indonesia	.531	-.575	1									
USA	-.578	.029	.073	1								
Hong Kong	-.937*	.247	-.268	.808**	1							
Thailand	.249	-.379	.733*	.119	-.033	1						
Malaysia	.792	.668*	-.196	-.149	.112	.159	1					
Philippines	.806	.631	-.124	-.395	-.396	-.077	.646*	1				
Vietnam	.780	.732*	-.214	-.537	-.310	-.059	.746*	.855**	1			
Singapore	.668	.726*	-.264	.169	.162	-.067	.659*	.794**	.586	1		
Macao	-.992**	-.209	.070	.925**	.843**	.130	-.254	-.663*	-.724*	-.111	1	
Korea	.778	.901**	-.581	-.048	.187	-.404	.717*	.681*	.723*	.811**	-.237	1

Table.7. Correlation coefficients between age stratums on monthly visitors 2003 to 2012.

Corr. Coeff.	% 12 and below	% 13 to 19	% 20 to 29	% 30 to 39	% 40 to 49	% 50 to 59	% 60 and above
% 12 and below	1						
% 13 to 19	.722**	1					
% 20 to 29	-.164**	0.019	1				
% 30 to 39	-.406**	-.400**	.586**	1			
% 40 to 49	0.025	-.113**	-.735**	-.275**	1		
% 50 to 59	-.454**	-.571**	-.675**	-.383**	.426**	1	
% 60 and above	-.439**	-.400**	-.426**	-.402**	-0.048	.731**	1

4.2. K-means clustering

Being a family of multivariate techniques useful for analysing cases based on their scores on a range of measured variables, clustering analysis identifies cases with a comparable pattern of responses that can be regarded, for the purposes of the analysis, as similar. The output of a successful cluster analysis would be a small number of highly homogeneous clusters that are substantially different to each other (Hair et al., 1998).

As a non-hierarchical algorithm, K-means clustering need to be determined the cluster number first and can be processed then. Cluster number was set to be 4 in this study, in other words, each monthly record in different markets was assigned into one and the only one of 4 clusters according to the shortest distance calculated from the inputted variables. Two clustering processes were conducted in this study, the first one was to classify all the monthly visitor arrivals in all countries into a proper cluster basing on gender's ratio, the second one was to classify records by the ratios of different age stratums. No matter in which attempt, cluster number was set to be 4 in this study. While table 8 gives the cluster belonging based on gender's ratios, table 9 displays the cluster belonging based on different ages' ratios.

Table 8. Cluster belonging based on gender's ratios

Year	Cluster	Hong Kong	Indonesia	Japan	Korea	Macao	China	Malaysia	Philippine	Singapore	Thailand	U.S.A.	Vietnam	Total
2003	1	3	1		2			3	9	1	2			21
	2	9				12			3				12	36
	3		3	10	8			1				1		23
	4		8	2	2			8		11	10	11		52
2004	1	7							10					17
	2	5				12							12	29
	3		1	11	11						1	2		26
	4		11	1	1			12	2	12	11	10		60
2005	1	9							12		2			23
	2	3				12							12	27
	3		1	12	12					1		3		29
	4		11					12		11	10	9		53
2006	1	10							10					20
	2	2				12							12	26
	3			12	10							3		25
	4		12		2			12	2	12	12	9		61
2007	1	12				1			7				2	22
	2					11							10	21
	3		1	12	2			1				3		19
	4		11		10			11	5	12	12	9		70
2008	1	11					6		8				6	31
	2	1				12							6	19
	3			12	9							4		25
	4		12		3			12	4	12	12	8		63
2009	1	12				5	5		9				10	41
	2					7	7						2	16
	3			12	12							2		26
	4		12					12	3	12	12	10		61
2010	1	11				10	8		5				11	45
	2					2	4							6
	3			12	12			2				1		27
	4	1	12					10	7	12	12	11	1	66
2011	1	11				12	10				2		10	45
	2						2							2
	3			12	12					1	3	2		30
	4	1	12					12	12	11	7	10	2	67
2012	1	10	1			12	12						10	45
	3			12	12					4		3		31
	4	2	11					12	12	8	12	9	2	68
Total		120	120	120	120	120	54	120	120	120	120	120	120	1374

Table 9. Cluster belonging based on different ages' ratios

Year	Cluster	Hong Kong	Indonesia	Japan	Korea	Macao	China	Malaysia	Philippine	Singapore	Thailand	U.S.A.	Vietnam	Total
2003	1	12		5	6	11		3	9	4	3	7	3	63
	2					1						1	8	10
	3		9	3	4			5		3	6	1		31
	4		3	4	2			4	3	5	3	3	1	28
2004	1	11		3	6	6		3	9	6	3	5		52
	2			2		6						3	10	21
	3		9	4	3			6		1	6	1		30
	4	1	3	3	3			3	3	5	3	3	2	29
2005	1	9		4	6	5		3	9	5	6	7	1	55
	2	2				7						1	9	19
	3		9	6	3			5		1	4	1		29
	4	1	3	2	3			4	3	6	2	3	2	29
2006	1	8		4	7	2		5	6	5	4	6		47
	2	3		1		10			3			3	10	30
	3		9	3	2			4		1	5	1		25
	4	1	3	4	3			3	3	6	3	2	2	30
2007	1	7		4	5	1		4	3	6	5	3		38
	2	3			3	11			5			4	10	36
	3		9	4				4	1	1	4	2		25
	4	2	3	4	4			4	3	5	3	3	2	33
2008	1	10		3	5	2		8	7	5	4	1		45
	2	2		1		10	6					6	11	36
	3		10	4	3				2	1	5	2		27
	4		2	4	4			4	3	6	3	3	1	30
2009	1	10		6	3	1		5	5	8	4	2		44
	2	2		1		11	12	3				8	10	47
	3		9	2	6			1	4		5			27
	4		3	3	3			3	3	4	3	2	2	26
2010	1	10		5		3		3	2	8	4	2		37
	2			1		9	12	1				7	10	40
	3		8	2	8			4	7		4	1		34
	4	2	4	4	4			4	3	4	4	2	2	33
2011	1	11	1	5		2		7		7	2	2		37
	2			1		9	12	1				8	10	41
	3		8	2	10				10	1	7			38
	4	1	3	4	2	1		4	2	4	3	2	2	28
2012	1	10	9	3		2		7		4	6	2		43
	2			2		8	12					7	10	39
	3			3	9			1	10	4	4			31
	4	2	3	4	3	2		4	2	4	2	3	2	31
Total		120	120	120	120	120	54	120	120	120	120	120	120	1374

4.3. 1-way MANOVA

Regarded as an extension of the independent samples t-test, analysis of variance (ANOVA) compares means of more than two groups at a time. If more than one dependent variable among groups should be compared, in comparison to running a series of ANOVAs, it is more effective and robust to run only one MANOVA. Testing the homogeneity of group means for multiple dependent variables, the 1-way MANOVA hypothesizes that the error variance of the dependent variable is equal across groups.

After clustering processes has been conducted, it is necessary to verify each cluster should have heterogeneous means. Since more than one dependent variable exists, 1-way MANOVAs therefore were processed to make clustering more reasonable and robust. Two 1-way MANOVAs, one for testing gender and one for testing age, were excused in this study. While the significant indexes, Wilks' Lambdas, of MANOVA, were both less than 0.05

overall, the Post Hoc comparison should be performed to discover which pairs of them were mutually different. Caused by the same restrictions just as correlation part, the results of Post Hoc would not be shown here. Table 10 summaries the tests of between-subjects effects for genders and ages.

Table 10. Tests of between-subjects effects for genders and ages

Source	DV	Type III SS	df	MS	F	Sig
QCL_gender	% of Male	11.431	3	3.810	4,603.989	0.000
	% of Femle	11.431	3	3.810	4,603.989	0.000
QCL_age	% of Aged 12 and below	1.171	3	0.390	679.221	0.000
	% of Aged 13 to 19	0.835	3	0.278	906.560	0.000
	% of Aged 20 to 29	3.402	3	1.134	1,120.922	0.000
	% of Aged 30 to 39	0.943	3	0.314	541.041	0.000
	% of Aged 40 to 49	0.668	3	0.223	210.362	0.000
	% of Aged 50 to 59	1.860	3	0.620	1,295.452	0.000
	% of Aged 60 and above	0.906	3	0.302	357.119	0.000

4.4. MDS

MDS is a set of data analysis techniques that display the structure of distance-like data as a geometrical picture. MDS transfers subject's distances in high dimension to a lower visible dimension for easy interpretation. The fitness measures of transformation contain S stress, stress, and RSQ. Experimental results shows that the fitness measures mentioned were quite acceptable. Caused by the same spacial restriction just as correlation part, only few derived stimulus configurations of MDS are shown here. While var1 to var10 representing China, Japan, Indonesia, USA, Hong Kong, Thailand, Malaysia, Philippines, Vietnam, Singapore, Macao, and Korea, respectively, figure 3 demonstrates stimulus graph in 10 years based on 7 age stratums. Figure 4 illustrates 6 stimulus graphs, including Japan, USA, Hong Kong, Malaysia, Singapore, and Macau, based on 7 age stratums during 2003 to 2012.

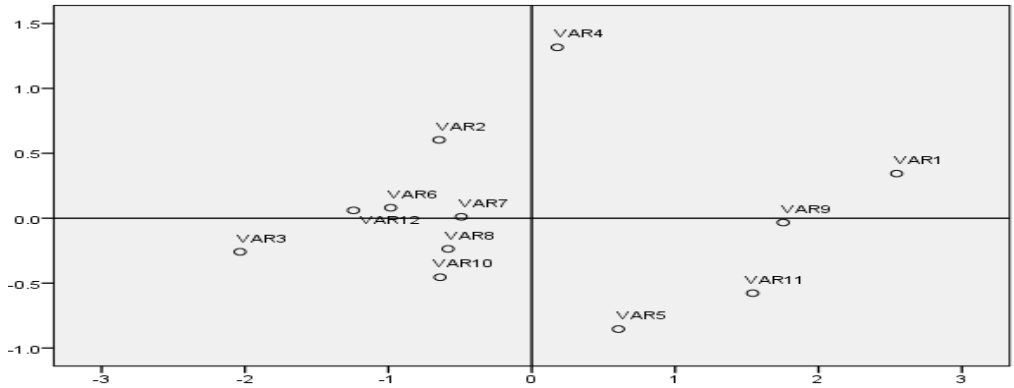

Fig. 3. The derived stimulus configurations cross 10 year in destinations

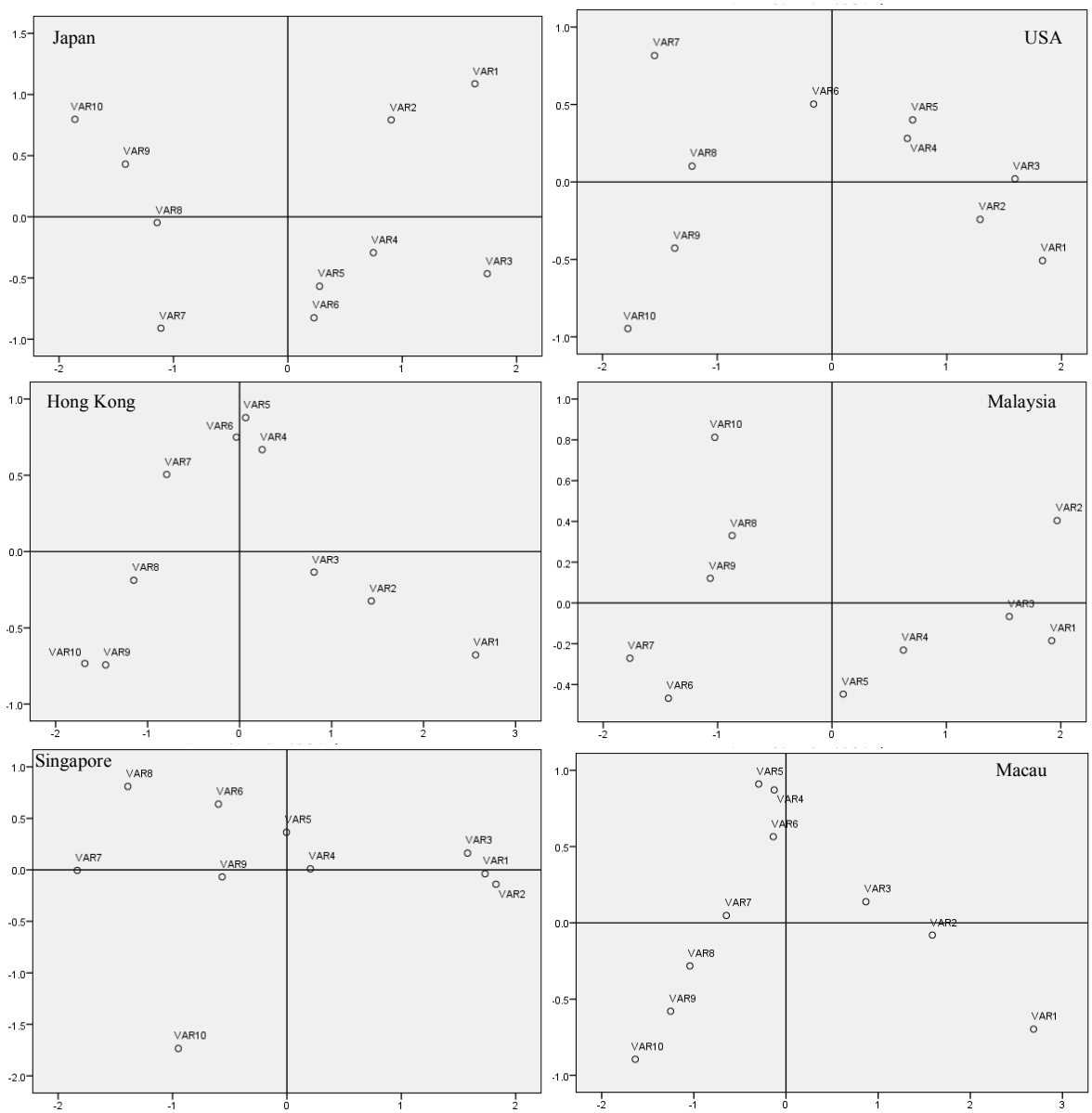

Fig. 4. The derived stimulus configurations cross 10 year in destinations

5. Discussion and conclusion

Tourism has become a highly competitive business. The competitive advantage no longer relies on natural resources only, yet increasingly on the level of technology, information and innovation offered (Burger, Dohnal, Kathrada & Law, 2001). Traditionally, tourism demand can be normally measured either by tourist arrivals at a destination, and tourists' expenditure while visiting, or nights stayed. Therefore, an accurate forecasting of tourist arrivals is helpful for planning for potential tourism demand to invest in tourism related facilities and improve tourism infrastructure (Chen et al., 2010).

Experiencing the prohibiting policy for citizen outbound tourism lifted in 1979, and ban of relative-visiting to mainland removed in 1987, the international outbound tourists have risen dramatically in Taiwan. Based on the official data offered by Tourism Bureau, M.O.T.C., Taiwan, monthly visitors with different genders and ages destined to 12 main outbound countries, including Japan, Hong Kong, Macau, Mainland China, Korea, U.S.A, Singapore, Thailand, Philippines, Indonesia, Malaysia, and Vietnam as well, from 2003 to 2012 have been collected and analyzed to demonstrate and explore the static and dynamic patterns behind these historical records.

Differing from the tourism demand forecasting wildly studied by researchers, this paper aimed to explore the spatiotemporal patterns implicitly behind historical records. Correlation analysis clarifies the correlative relation among each different researched target. By time-freezing and time-slicing, this study successfully extracted out the static weights of different genders and ages in each market, and traced the dynamic variations of observed objectives mentioned above. Records with similar patterns, or equivalently closer distances, were classified into same group in K-mean clustering process. Objects in the same cluster should inherit similar patterns, with distance closer, or even more competitive in attracting Taiwanese visitors. MANOVAs further confirmed such clustering to be reasonable and effective by hypothesis-testifying the heterogeneous cluster centers. Lastly, MDSs successfully transformed the mutual distances and relative positions from high-dimension into a 2-dimensional, visible, and interpretable space. Thus, MDSs granted us the capability of observing, as time goes by, the changing or evolution with respect to the same objective.

References

Burger, C. J. S. C., Dohnal, M., Kathrada, M., Law, R. (2001). A practitioners guide to time-series methods for tourism demand forecasting – a case study of Durban, South Africa. Tourism Management, 22, 403-409.

Chan, Y. M. (1993). Forecasting tourism: A sin wav time series regression approach. Journal of Travel Research, 32, 58-60.

Chandra, S., & Menezes, D. (2001). Applications of multivariate analysis in international tourism research: The marketing strategy perspective of NTOs. Journal of Economic and Social Research, 3(1), 77-98.

Chen, K. Y., & Wang, C. H. (2007). Support vector regression with genetic algorithms in forecasting tourism demand. Tourism Management, 28, 215-226.

Chen, M. H., Ying, L. C., & Pan, M. C. (2010). Forecasting tourist arrivals by using the adaptive network-based fuzzy inference system. Expert Systems with Applications, 37, 1185-1191.

Cho, V. (2003). A comparison of three different approaches to tourist arrival forecasting. Tourism Management, 24, 323-330.

Chu, F.L (2008). Analyzing and forecasting tourism demand with ARRA algorithm. Tourism Management, 29, 1185-1196.

Chu, F. L. (1998). Forecasting tourist arrivals: A combined approach. Tourism Management, 19(6), 515-520.

Crouch, G.I., Schultz, L., & Valerio, P. (1992). Marketing international tourism to Australia: A regression analysis. Tourism Management, 13, 196-208.

Goh, C., & Law, R. (2002). Modeling and forecasting tourism demand for arrivals with stochastic nonstationary seasonality and intervention. Tourism Management, 23, 499-510.

Hair, J., W. Black, B. Babin, R. Anderson and Tatham (1998), Multivariate Data Analysis, Upper Saddle River, NJ: Prentice-Hall.

Hernandez-Lopez, M., & Caceres-Hernandez, J. J. (2007). Forecasting tourists' characteristics by genetic algorithm with a transition matrix. Tourism Management, 28, 290-297.

Hernandez-Lopez, M. (2004). Future tourists' characteristics and decisions: The use of genetic algorithms as a forecasting method. Tourism Economics, 10(3), 245-262.

Hiemstra, S. J., & Wong, K. F. (2002). Factor affecting demand for tourism in Hong Kong. Journal of Travel and Tourism Marketing, 12(1-2), 43-62.

Hsu, C. I., & Wen, Y. U. (1998). Improved grey prediction models for trans-pacific air passenger market. Transportation Planning and Technology, 22, 87-107.

Hurley, S., Moutinho, L., & Witt, S. F. (1998). Genetic algorithms for tourism marketing. Annals of Tourism Research, 25(2), 498-514.

Kulendran, N., & Witt, S. F. (2001). Cointegration versus least squares regression. Annals of Tourism Research, 29(2), 291-311.

Larry D., Alison G., & Neelu S. (2012). Handbook of research methods in tourism. Edward Elgar Publishing Limited.

Law, R. (2000). Back-propagation learning in improving the accuracy of neural network-based tourism demand forecasting. Tourism Management, 21, 331-340.

Law, R. & Au, N. (1999). A neural network model to forecast Japanese demand for travel to Hong Kong. Tourism Management, 20, 89-97.

Lim, C., & McAleer, M. (2000). Time series forecasts of international travel demand for Australia. Tourism Management, 23, 389-396.

Smeral, E., Witt, S. F., & Witt, C. A. (1992). Econometric forecasts:Tourism trends to 2000. Annals of Tourism Research, 19(3), 450-466.

Song, H & Witt, S. F. (2010). Estimating the size of Chinese outbound travel market: A demand-size approach. Tourism Management, 31, 250-259.

Song, H., & Witt, S.F. (2000). Tourism demand modeling and forecasting: modern econometric approaches. Oxford: Pergamon.

Song, H., & Witt, S. F. (2006). Forecasting international tourist flow to Macau. Tourism Management, 27, 214-224.

UNWTO. (2013). UNWTO Tourism Highlights 2013 Edition. UNWTO e-library.
Wang, C. H. (2004). Predicting tourism demand using fuzzy time series and hybrid grey theory. Tourism Management, 25, 367-374.
Wang, C. H., & Hsu, L. C. (2008). Constructing and applying an improved fuzzy time series model: Taking the tourism industry for example. Expert Systems with Applications, 34(4), 2732-2738.
Witt, S. F., & Martin, C. (1987). Econometric models for forecasting international tourism demand. Journal of Travel Research, 25(3), 23-30.
Wong, K. K. F., Song, H., & Chon, K. S. (2006). Bayesian models for tourism demand forecasting. Tourism Management, 27, 773-780.